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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/664,157  
Filing Date: September 17, 2003  
Appellant(s): KIM ET AL.

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**EXAMINER'S ANSWER**

This is in response to the appeal brief filed August 17, 2007 appealing from the Office action mailed.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

5,961,672	Skotheim et al.	10-1999
6,245,458	Sotomura	6-2001
6,030,719	Fauteux et al.	2-2000

JP 10-101793                    Zuiho                    04-1998

**(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 1-7, 9-17, 19-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Skotheim et al. (US Patent 5,961,672) in view of Sotomura (US Patent 6,245,458 B1).

In regard to claims 1-4, 6, 7, 9, 20, 21, 24, the Skotheim et al. discloses a secondary battery with a composite lithium anode that stabilizes against dendrite formation with a thin film of lithium ion-conductive polymer interposed between the lithium metal and the electrolyte (Column 2, Lines 41-45). The Skotheim et al. reference further discloses that the electroconductive polymer film may be any conjugated structure, which is capable of being doped electrically conductive by lithium ions (Column 6, Lines 55-58), but does not disclose an organosulfur protective layer. However, the Sotomura reference discloses an electrode composite that can be used in a metallic lithium anode (Column 2, Lines 1-4), which exhibits high energy density and gives a high charging and discharging efficiency and good charging and discharging cycle life property used in a secondary battery (Column 2, Lines 39-44). The lithium electrolyte as part of the electrode gelled with a polyethylene oxide polymer (Column 5, Lines 43-58) onto the electrode composite of 2,5, dimercapto-1,3,4-thiadiazole (Column 4, Line 15) with an electrically conductive support such as doped polyaniline (Column 4, lines 56-60). Therefore, it would have been obvious to one of ordinary skill at the time the invention was made to incorporate the organosulfur protective layer as disclosed by

Sotomura reference to the lithium anode as disclosed by the Skotheim et al. reference in order to provide a secondary battery with high energy density and current output.

In regard to claims 5, 19, 23, it would have been obvious to one of ordinary skill to only put an organosulfur (100wt %) on the electrode and no polyaniline (0 wt%) compound or polyethylene oxide (0 wt %) as a reference electrode for testing purposes and comparative examples.

In regards to claim 22, the Sotomura reference discloses the average molecular weight of the ionic conductive material to have an average molecular weight to be 20,000 (Column 6, Lines 17-23)

It is noted that claims 10-17 are product-by-process claims. "Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). Since, the doped electron conductive polymer as disclosed by Sotomura is similar to that of the Applicant's, Applicant's process is not given patentable weight in this claim.

2. Claims 8 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Skotheim et al. (US Patent 5,961,672) in view of Sotomura (US Patent 6,245,458 B1) as applied to claim 6, in further view of Zuiho et al. (JP Publication 10-101793).

In regard to claims 8 and 18, the Sotomura reference discloses the use of polyaniline polymer obtained by means of an electrolytic polymerization from aniline or derivatives with an electric conductivity of  $10^{-5}$  S/cm (Column 4, Lines 30-47). However, it does not disclose the use of emerald base polymer made of polyaniline or a doping ratio of about 30%. The Zuiho et al. discloses polyaniline emerald base polymer with the electric conductivity in the range of  $10^{-10}$ - $10^1$ S/cm (Abstract). It would have been obvious to one of ordinary skill at the time the invention was made to replace polyaniline as disclosed by Sotomura with other polyaniline derivatives such as the polyaniline emerald base compound with the same physical properties as disclosed by Zuiho et al., since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Furthermore, the electron conductive polymer polyaniline is the same as the Applicants' claimed invention, therefore, the physical property is the same such as the doping ratio of at least 30%.

3. Claim 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Skotheim et al. (US Patent 5,961,672) in view of Sotomura (US Patent 6,245,458) in further view of Chu (US Patent 5,523,179) as evidence by Fauteux et al. (US Patent 6,030,719).

The Skotheim et al. discloses a secondary battery with a composite lithium anode that stabilizes against dendrite formation with a thin film of lithium ion-conductive polymer interposed between the lithium metal and the electrolyte (Column 2, Lines 41-45) and the Sotomura reference discloses an organosulfur protective layer on

composite electrodes, but does not disclose weight percentage of the compounds. However, the Chu reference discloses lithium/organosulfur batteries are known to be low cost and low equivalent weight (Column 2, Lines 1-3). The Chu reference further discloses an active-sulfur material in a weight percent of 20 to 80%, an ionically conductive material of 15%, and 40% electronically conductive material (Claim 42(b)). It would have been obvious to one of ordinary skill to combine the active material with the weight percentage as disclosed by Chu to the electrodes as disclosed by Skotheim et al. in order to produce an efficient battery of low cost and weight. Furthermore, the Fauteux et al. presents evidence in a secondary battery cell configuration, that an anode and cathode will become interchangeable with each other depending on whether the cell is charging or discharging (Column 3, Lines 41-44).

#### **(10) Response to Argument**

1. The Applicants argue, "*One of ordinary skill in the art faced with the problem presented in Skotheim would not look to the teaching of Sotomura because the references address completely different problems. Skotheim is directed at providing a lithium metal anode that has been stabilized against dendrite formation, whereas Sotomura is directed at providing a cathode electrode composition containing an organic sulfide compound.*

*In the Advisory Action, the Examiner asserts that "the Sotomura reference teaches an organo-sulfur composite electrode capable of being doped electrically with lithium ions and teaches that the composite layer exhibits high energy density and gives a high charging and discharging efficiency and good charging and discharging cycle lift*

*which provides motivation to combine the organosulfur composite into the anode as taught by Skotheim."*

*However, this statement fails to provide a reason why one of ordinary skill would combine a teaching regarding a cathode electrode, which does not include a lithium metal layer, and a teaching regarding an anode electrode, which does include a lithium metal layer, into a single electrode. It is again noted that an electrode doped with lithium ions does not include a lithium metal layer."*

In response to these arguments, the Sotomura reference does not limit the electrode composite to be solely for a cathode. While the Sotomura uses the electrode composite in the cathode for some examples, the Sotomura maintained an extensive teaching of the composite electrode used broadly. For example, Column 1-2; lines 65-4 states "On the other hand, among the organic sulfide compounds having a thiol or thiolate group in their molecules, the specified organic disulfide compound as described above gives a battery which provides a high voltage of not lower than 3V if combined with a metallic lithium anode." In addition, the Sotomura reference discloses organic disulfide to be used in two scenarios when it is being oxidized and when it is being reduced (Column 2, Lines 10-14). Furthermore, the claimed invention of the Sotomura reference teaches a composite electrode (Column 12, Lines 44-59) and not a cathode.

2. The Applicants argue, "*The Office Action does not establish a prima facie case of obviousness because the combined references fail to disclose all of the claimed features.*

*The combined references fail to disclose an organosulfur compound in a negative electrode for a lithium battery, as required by claims 1 and 24. Skotheim discloses a secondary battery including a composite lithium anode and a thin film of lithium ion-conductive polymer interposed between the lithium metal and the electrolyte. However, Skotheim fails to disclose a protective layer including an organosulfur compound and an ionic conductive polymer.*

*The Examiner relies on Sotomura to cure this deficiency in Skotheim. Sotomura teaches an electrode composite including an organosulfur compound and a polymer electrolyte (see column 4, line, 15 and column 5, lines 43-58). However, this electrode composite does not include a lithium metal layer and is used as the cathode electrode, not as the anode electrode (see column 1, lines 10-11 and column 5, line 66-column 6, line 2).*

*Therefore, Sotomura does not teach an organosulfur protective layer in a metallic lithium anode, as the Examiner asserts on page 3 of the Office Action. Rather, as stated by the Examiner on page 8 of the Office Action, "The Sotomura et al. reference uses a composite electrode with an organic disulfide fro [sic] a battery which provides high voltage when used with a lithium anode." This statement makes it clear that the organic disulfide is not a part of the metallic lithium anode, but rather is a part of the composite electrode. In the Advisory Action, the Examiner argues that the organo-sulfur containing composite electrode of Sotomura is doped with lithium ions. However, lithium ions do not constitute a lithium metal layer. As such, the composite electrode of Sotomura does*

*not disclose organosulfur protective layer in a metallic lithium anode and therefore, fails to cure the deficiency of Skotheim.*

In response to the Applicant's arguments, the Skotheim reference discloses a secondary battery with a composite lithium anode that stabilizes against dendrites formation with a thin film of lithium ion-conductive polymer (or the protective layer) interposed between the lithium metal and the electrolyte. The Skotheim reference discloses that the ion-conductive polymer film may be any conjugated structure which is capable of being doped electrically by lithium ions and that the list of polymers is illustrative and not intended to be exhaustive (Column 6; Lines 55-62). The Sotomura reference discloses an organic disulfur compound having a thiol or thiolate group (as an example) **combined** with a metallic lithium anode (Column 1-2, lines 65-67, 1-4) as the electrode composite. The organo-sulfur containing composite electrode of Sotomura is doped with lithium ions is evidence that this organo-sulfur containing composite electrode can be used in the Skotheim reference as the ionic conductive protective layer because the Skotheim reference requires that the polymer used can any polymer that is capable of being doped with lithium ions. Therefore, the broad disclosure of the organo-sulfur containing composite electrode as disclosed by Sotomura can be used as the ionic conductive protective layer of the Skothiem et al. reference.

*The Examiner further contends, in both the Office Action and the Advisory Action, that an anode and a cathode become interchangeable in a secondary battery. However, the Examiner applies this assertion incorrectly. Skotheim and Sotomura describe the*

*initial anode and the initial cathode. When the battery is charged or discharged, the charges of the electrodes may change. However, the materials of the electrodes do not change. In both Skotheim and Sotomura, the electrode that is initially negatively charged is referred to as the anode and includes a lithium metal layer, and the electrode that is initially positively charged is referred to as the cathode and does not contain a lithium metal layer. Neither reference discloses the inclusion of an organosulfur compound and an ionic conductive polymer in an electrode comprising a lithium metal layer, as required by independent claims 1 and 24."*

In response to these arguments, these arguments are mere assertions of which the Applicants did not provide any evidence to support the arguments. The Sotomura reference describes oxidation and reduction of the battery is repeated using the electrode composite (Column 2, Lines 4-7) and the Skotheim discloses the insertion and desorption of lithium ions (Column 5, Lines 40-45) both of the Skotheim and Sotomura reference discloses a rechargeable battery. The cathode being used can be negatively charged and the anode being used can be positively charged or vice versa. During charging of the rechargeable battery the chemical reactions in the anode is being oxidized producing electrons and the chemical reactions in the cathode is being reduced or using electrons. During discharging the opposite occurs the anode is being reduced or using electrons and the cathode is oxidized or producing electrons. The chemical reactions come from the compounds used in electrode composites. Whether the composite is used as an anode the chemical reactions will be the same as the cathode during discharging or vice versa, hence the composite can be used on either

the anode or a cathode to provide the same chemical reaction. The Skotheim reference discloses an anode with a lithium layer, electrolyte and any ionic conductive protective layer that is capable of doping lithium ions. The Sotomura reference discloses a composite electrode comprising an organosulfur layer that is capable of doping lithium ions and provides motivation.

3. Appellants respectfully submit that claim 1 is allowable over Skotheim and Sotomura, and Zuiho fails to cure the deficiencies of Skotheim and Sotomura noted above with regard to claim 1. Hence, claims 8 and 18 are allowable at least because they depend from an allowable claim 1.

Again, these arguments are mere assertions of which the Applicants did not provide any evidence to support the arguments.

4. The Applicants argue, “*Neither Chu nor Fauteux discloses an organosulfur protective layer in a metallic lithium anode. Chu discloses an active-sulfur material in a positive electrode, but provides no such teaching regarding a negative electrode. In the Office Action, the Examiner cited Fauteux for the teaching that an anode and cathode become interchangeable with each other depending on whether the cell is charging or discharging. However, the Examiner once again applied this teaching incorrectly. Even if the negative electrode of Chu, which comprises a lithium metal layer, becomes the positive electrode, and the positive electrode of Chu, which comprises the active-sulfur material, becomes the negative electrode, one does not arrive at the claimed invention. Rather, in this scenario, the negative electrode comprises an active-sulfur material, but not a lithium metal layer. Therefore, none of the references teach an*

*electrode including both an organosulfur material and a lithium metal layer, as required by independent claim 24."*

Again, these arguments are mere assertions of which the Applicants did not provide any evidence to support the arguments. The Examiner believes the Applicants have mistaken. The Fauteux reference was applied to demonstrate that it is known to one of ordinary skill in the art to interchange the cathode and the anode because the chemical reactions of the compounds are the same depending on whether the battery is charging or discharging of which was explained above. Furthermore, the compounds are capable of intercalating lithium as the anode or the cathode, whether the lithium comes from a layer or just lithium ions, it does not make a difference in chemical reactions if it is used in the anode during discharging or a cathode during charging.

Further the Chu reference was incorporated to disclose the electronically conductive material and the ionically conductive material to be of a certain weight percentage. Furthermore, the Chu reference disclose that the surface of such negative electrodes can be modified to include a **protective layer**, such as that produced on the **negative electrode by the action of additives, including organosulfur compounds** (Column 6, Line 35-40) which reinforces the combination of Skotheim and Sotomura.

#### **(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Helen Chu



Conferees:

\*\*\* William Reynolds WMR  
TQS 1700

MATTHEW JOSEPH RYAN  
CERTIFIED PATENT EXAMINER

